THE DENTAL PRACTITIONER

monthly journal for the Practitioner and his Staff

VOL. I, NO. 3 NOVEMBER, 1950

CONTENTS

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CONTENTS

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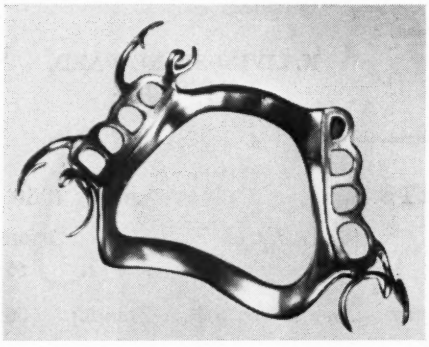

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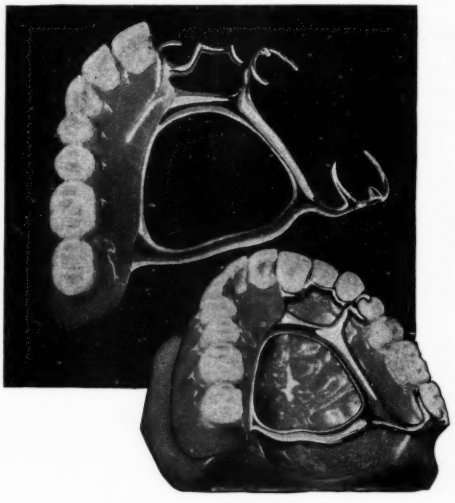

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THE
DENTAL PRACTITIONER

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Vol. I, No. 3 November, 1950

DITORIAL

UNDER WAY!

HERE we present the third number of this new periodical and we sincerely hope that it will be enjoyed at least equally as much as were the two earlier ones. Many have written to tell us that we are doing well and we appreciate their encouragement.

Last time we ventured to complain, however, that we had received all praise and no criticism. That complaint still holds good—with a slight modification. We have now attracted the sceptics, who, of course, are always around. "It can't last"—"It's too good"—"The production is too expensive"—"The dental profession are notoriously lethargic towards dental literature"—and so on. Well, this time they would seem to be even less right than usual. We have charted our course and are "under way" and we intend to keep sailing; the passage so far has been delightfully smooth.

The teaching hospitals have held out a helping hand; some have already produced excellent articles and case histories and others are following on to keep the pace steady. In addition, we have so far received several unsolicited articles and hints, and have been given a number of suggestions for future articles, all of which is very helpful. Every ship must have something in reserve and be able to "ride out a storm", so once again we ask you, individually, to send us suggestions, articles, hints, case histories, abnormal X-rays —anything which will be of interest, because if something has interested you then doubtless it will interest others also.

So let the gale blow and manuscripts and mail descend upon us—maybe in the process our sceptics will be submerged !

> "It is a general rule that the more treatments that are advocated for any condition, the less is known of its real nature, pathology, and cause."

A CLINICAL INVESTIGATION IN PREVENTIVE DENTISTRY

By **JOHN MILLER**, B.D.S. (Manch.)

Lecturer in Preventive Dentistry, Turner Dental School, University of Manchester

In early 1947 an examination was made of the dental condition of approximately 1100 children in Manchester. This was a preliminary survey in a research scheme which was designed to investigate the relative merits of certain treatments as caries prevention measures. The treatments were: (1) oral hygiene; (2) applications of silver nitrate to posterior permanent teeth; (3) the filling of all pits and fissures in posterior teeth with copper cement; (4) applications of sodium fluoride to all teeth. The broader aspects of the general dental treatment of children were to be studied concurrently.

The children were pupils at three schools near the Turner Dental School, and in general the homes from which the children came were of the poorer types. There was a considerable Irish and Scottish element, together with a sprinkling of coloured races in varying degrees of purity.

Forms of acceptance of treatment were sent to the parents of all children in the schools and treatment was accepted for approximately 900 children. These children were consequently arranged into six groups, evenly distributed for age and sex. The groups were numbered and full mouth treatments decided upon as follows:—

Group 1: Oral hygiene.
Group 2: Oral hygiene; Silver nitrate.
Group 3: Oral hygiene; Black copper cement.
Group 4: Oral hygiene; Sodium fluoride.
Group 5: Oral hygiene.
Group 6: Oral hygiene.

Groups 5 and 6 were originally intended as reserve groups for other preventive measures. For simplicity in this report Groups 1, 5, and 6 will be referred to as a single group, Group 1.

Control of the preventive treatments was to be by comparison with general caries rates; it is sometimes termed the "baseline" or "yardstick" method of control. It will be discussed in more detail later. The group receiving oral hygiene would show the part played by oral hygiene in the other groups.

The investigation was designed to be of the serial type. Initial treatments were spread over the first six experimental months and successive treatments were given at regular intervals of six months. Thus a child commencing in January, 1948, would complete his first experimental year in January, 1949. A child commencing in June, 1948, would complete the first experimental year in June, 1949. It will be observed that the time required for the whole number of children to complete one experimental year is eighteen months; similarly a two-year survey requires two and a half years, and so on.

The examination for caries and parodontal condition was made after oral hygiene had been carried out, thus ensuring equal frequency of examination and treatment for every child.

Standards of Diagnosis.—

a. Caries (Jackson, 1950, a).—A sharp Ash No. 54 sickle probe was employed to diagnose pit and fissure lesions. The smallest lesions recorded were those in which the probe entered the pit or fissure with light pressure and required a definite pull for removal. All definite penetrations of the probe to dentine were included as caries.

Proximal caries was recorded if an Ash No. 23 probe detected a definite breach in the enamel, even though not visible to the naked eye. Arrested caries was recorded as caries.

b. Parodontal Conditions.—The parodontal tissues show a wide variety of lesions. To record all types of lesions and their aetiology would have proved unwieldy in a survey of this nature. A gingivitis may be marginal,

papillary, localized, or general. Likewise the cause may be local or systemic.

The following broad classification was considered to be sufficient for the purpose of this research programme:—

Good.—A healthy condition with firm, pink mucosa.

Fair.—Simple gingivitis, slight inflammation of the mucosa with bleeding on slight digital pressure.

Poor.—Cases showing acute or chronic hyperplastic gingivitis, regardless of extent, cause, or site.

Standards of Measurement.—

a. Caries.—The measurement of caries incidence was made by using the D.M.F. index for permanent teeth and d.m.f. index for deciduous teeth.

The initials D.M.F. and d.m.f. denote Decayed, Missing, and Filled teeth in the appropriate dentition. It is assumed that any missing tooth has been carious at some time, but the term missing does not apply to unerupted teeth. It is thus an index of the carious attack that has occurred in the mouth up to the time of examination.

The estimation of the caries incidence in deciduous teeth has been made according to Jackson's (1950, a, b) method, which can be employed from age 3 to 8 years. The index d.m.f. for all deciduous teeth can be recorded up to 5 years of age inclusive, since up to this age exfoliation will not affect the caries index to any serious degree.

From the age of 3 to 8 inclusive the d.m.f. index for the deciduous molars will give a fairly true picture of the caries incidence. Thus an assessment of the caries incidence during the period of the change from one dentition to another is possible.

Both D.M.F. and d.m.f. have been expressed as average D.M.F. and average d.m.f. per 100 children respectively.

b. Parodontal Conditions.—The parodontal conditions have been expressed as a percentage incidence of each classification, good, fair, or poor, in each age grouping.

c. Definition of Ages.—The recorded age of a child was the number of complete years at the time of examination.

PREVENTIVE TREATMENT AND METHODS OF APPLICATION

1. Oral Hygiene.—Oral hygiene has been advocated for some years as a preventive measure both for carious and parodontal lesions. Fones (1919) reported results from a general health programme which included regular dental prophylaxis and dental instruction. A reduction of 30 per cent to 60 per cent in the caries rate was reported over a five-year period.

In this investigation it was proposed to render regular dental prophylaxis by hygienists to all children in the scheme, and to back this up by full dental hygiene instruction. This work was to be carried out entirely by hygienists. All stains and accretions were removed from the teeth and this was followed by polishing with brushes and rubber cups. Emphasis was laid on the great importance of thorough interdental cleansing and polishing by means of strips and floss silk. Pits and fissures were cleansed by brushing in all directions and searching with fine probes. On completion an inspection of the prophylaxis was made by a dental surgeon and a full dental inspection was carried out. The prophylactic paste used was a standard variety from one of the dental supply companies. After completion of the treatment, each child was fully instructed in the use of the toothbrush.

Most of the children came from poor families and it was felt that the cost of dentifrice might preclude its use by many of them so that the full benefit of such treatment and instruction would not be gained. One of the manufacturers of dentifrice very generously volunteered to supply all children with blocks of dentifrice free. Toothbrushes were at first supplied at reduced prices. Later the same manufacturers came again to our aid and enabled us to supply each child with a free toothbrush as well as dentifrice. Thus the financial barrier to full home care was reduced as far as possible.

2. Silver Nitrate.—The application of silver nitrate has been advocated for many years as a preventive measure. Theories to explain its action comprise anti-enzyme action, bactericidal action, reduction of solubility of the

enamel in acid, and mechanical obstruction of faults in the tooth surface. Klein and Knutson (1942) reported negative results from a three-year investigation applying silver nitrate once a year.

In this investigation it was decided to apply silver nitrate twice a year to the molar and bicuspid teeth of the permanent dentition. The solution employed was:—

Silver nitrate	..	3 g.
Distilled water	..	1 ml.
Ammonium hydroxide (28 per cent)..		2·5 ml.

The solution was applied to the appropriate teeth after prophylaxis. Each half of the mouth was isolated by cotton rolls and the solution rubbed on to the surfaces of the teeth after they had been dried with cotton-wool and warm air. The solution was maintained in contact with the surfaces of the teeth for one minute and then precipitated with eugenol for 30 seconds. The excess of the fluid was removed with cotton and the child allowed to rinse with water. The same procedure was repeated on the opposite side of the mouth.

3. Black Copper Cement.—The pits and fissures of bicuspid and molar teeth of the permanent dentition appear to constitute the areas of greatest susceptibility (*Table V*). It was considered that if these areas could be filled or occluded with cement without resort to operative measures the carious process might be arrested or prevented. Using Group 3, it was decided to investigate the ability of Ame's Black Copper Cement to occlude carious and non-carious pits and fissures. This cement is extremely tenacious and when mixed thinly will enter to a varying degree pits and fissures and remain there for some time.

After prophylaxis the bicuspid and molar teeth of one-half of the mouth were isolated by cotton rolls and dried. A thin mix of the cement was run on to the pits and fissures and teased down the fissures as far as possible with a probe. The teeth were kept dry until the cement had set. The opposite side of the mouth was similarly treated.

4. Sodium Fluoride.—From available literature it appears that 2 per cent sodium fluoride has been used most often in evaluating the effect of topical applications of this salt to the teeth. It has been claimed that 0·1 per cent and 1 per cent sodium fluoride are as effective as the 2 per cent solution in reducing caries incidence. In the present series 1 per cent sodium fluoride was used, as it allows a bigger safety margin from possible toxic effects from accidental overdose than does 2 per cent sodium fluoride. As a comparison with the other treatments was proposed, the application was made once every six months.

After prophylaxis the teeth of half the mouth were isolated, dried, and the 1 per cent solution of sodium fluoride rubbed with cotton pellets over all surfaces of all teeth. The solution was allowed to remain in contact for two minutes, after which the child was allowed to spit out any excess fluid from the mouth but not to rinse with water. The same procedure was repeated on the other side of the mouth.

RESULTS OF STATIC SURVEYS

a. **Caries.**—

First Examination.—The 1947 examination of all children present at the schools was made without previous prophylaxis. Gross debris was removed by cotton-wool, and interdental stripping utilized when necessary in cases of doubtful caries.

Second Examination.—The 1948 examination was made on the child's entry to the scheme during January–June, 1948. This examination was carried out at the Hospital after prophylaxis and prior to any preventive treatment. All subsequent examinations and chartings were made immediately after prophylaxis and before the child received any additional preventive measure or left the chair.

Later Examinations.—The 1949 and 1950 examinations were the initial examinations on the children who in January to June, 1949 and 1950, were entering the scheme for the first time. They were made after dental prophylaxis had been given.

Table I gives the results obtained from these surveys. The effect of prophylaxis prior to diagnosis on the caries rates is well seen in the differences between the 1947 and 1948

results. The 1949 rates correlate closely with the 1948 rates and act as a good check on the accuracy of the 1948 survey as a "yardstick" for control purposes.

Table I.—Caries Attack Rates of the Static Surveys, 1947, 1948, 1949, and 1950

Examinations made on Children on Commencement of Treatment

In 1947 no prophylaxis was given before examination.
In 1948, 1949, and 1950 prophylaxis was complete immediately before examination.

Age	1947		1948		1949		1950	
	No. of Children	Average D.M.F. per 100	No. of Children	Average D.M.F. per 100	No. of Children	Average D.M.F. per 100	No. of Children	Average D.M.F. per 100
				All Deciduous Teeth				
3	8	75	—	—	12	533	10	400
4	35	343	9	445	40	450	15	580
5	128	480	42	607	109	539	74	550
				Deciduous Molars				
3	8	75	—	—	12	342	10	260
4	35	243	9	263	40	348	15	387
5	128	361	42	455	109	396	74	420
6	122	396	104	485	97	450	42	510
7	128	432	89	510	44	445	35	560
8	131	427	71	499	30	520	—	—
				Permanent Teeth				
6	122	64	104	103	97	102	42	40
7	128	147	89	216	44	170	35	171
8	131	166	77	255	30	233	22	232
9	127	235	95	265	30	253	24	289
10	129	266	102	403	27	345	14	300
11	124	318	97	481	26	465	11	336
12	80	469	62	550	13	731	16	547
13	96	573	64	709	22	732	11	536
14	—	—	54	812	5	780	7	757
15	—	—	—	—	7	922	—	—

Table II.—Average D.M.F. Rates per Hundred Children: Individual Permanent Teeth

Age	Second Permanent Molar	First Permanent Molar	Premolars	Canines	Incisors
6	0	64	0	0	0
7	0	145	2	0	0
8	0	163	2	0	1
9	0	228	4	0	3
10	16	215	18	0	17
11	38	231	31	0	18
12	120	260	60	1	28
13	145	287	87	0	54

b. **Individual Tooth Caries Rates.**—Based on the 1947 examination, the caries attack rates were analysed for individual permanent and deciduous teeth. These are shown in *Tables II* and *III*. The tables indicate that in both dentitions the most susceptible are the molars. Comparison of the first and second permanent molar D.M.F. rates provides further evidence

that teeth of a similar anatomical shape have the same susceptibility to caries after equal periods of exposure to mouth fluids. The first permanent molar at the age of 7 and the second permanent molar at the age of 13, have been erupted for a similar period of time. The respective decay rates correlate closely.

Table III.—Average d.m.f. Rate per Hundred Children: Individual Deciduous Teeth

Age	Molars	Canines	Incisors
3	75	0	0
4	243	20	80
5	361	39	80
6	396	40	—
7	432	42	—
8	427	36	—

c. **Caries and Sex.**—A comparison of the two columns in *Table IV* shows very little sex difference in caries rates in the deciduous teeth. In the permanent teeth there is a slightly higher rate in the girls.

Table IV.—Average D.M.F. and d.m.f. Rates per Hundred Children: Males and Females

Age	Deciduous Molars		Permanent Teeth	
	Males	Females	Males	Females
3	84	50	—	—
4	212	261	—	—
5	347	360	12	12
6	460	349	47	75
7	470	388	133	163
8	431	420	136	191
9	—	—	245	228
10	—	—	216	297
11	—	—	305	330
12	—	—	396	521
13	—	—	505	623

d. **Sites of Caries Lesions in Permanent Teeth.**—*Table V* was compiled by analysing the sites of carious lesions in fifty children from each age group. The survey from which this data was extracted was the 1948 charting which was carried out after prophylaxis. The table shows that very little proximal caries is present before the age of 10 in the permanent teeth even if it is assumed that all compound cavities are proximal.

Table V.—The Sites of Caries Incidence

(Each figure is the summation of teeth having purely occlusal, purely buccal, or lingual pits, etc.)

	Second Permanent Molar						First Permanent Molar						Second and First Permanent Premolars						Permanent Incisors					
Ages	6	7	8	9	10	11	12	13	14	6	7	8	9	10	11	12	13	14	6	7	8	9	10	11	12	13	14
Purely occlusal	—	—	—	—	13	49	69	110	129	30	96	96	104	117	104	91	82	65	—	—	1	—	17	29	25	26	41	—	—	—	—	—	—	—	—	—
Purely *buccal* or *lingual* pits *Buccal* or *lingual* pits and occlusal	—	—	—	—	1	—	3	2	1	4	4	4	2	2	7	2	—	1	—	—	—	—	—	—	—	—	—	—	—	—	4	7	3	4		
	—	—	—	—	—	2	1	6	4	5	11	11	17	22	22	17	14	9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
Purely approximate surfaces	—	—	—	—	—	—	1	—	1	—	—	—	—	2	—	1	2	—	—	—	1	—	—	2	12	11	11	—	—	—	3	3	4	16	9	30
Compound	—	—	—	—	—	—	2	4	1	2	—	4	5	11	9	12	11	18	—	—	1	—	9	6	12	15	15	—	—	—	—	3	4	—	2	

RESULTS OF SERIAL TREATMENTS

Method of Control.—It was not intended that fine degrees of caries reduction should be demonstrated by this experiment, as it was considered that, if any measure was to be of practical value it should cause a marked reduction in the general caries rate of the treated group. The caries rates shown in the 1948 examination were thus taken as the standard. The caries rates of the treated group after a period of treatment could be compared to this "yardstick". The caries rates of the children who joined the schools each year would act as a check on the accuracy of the "yardstick" and show whether external influences were affecting caries rates in general.

A comparison of the permanent teeth caries rates in 1948, 1949, and 1950 in *Table I* shows little variation between the 1948 "yardstick" and the successive new entries, taking the overall picture up to the age of 13. The Groups 2, 3, and 4, i.e., silver nitrate, black copper cement, and sodium fluoride, were controlled against the oral hygiene group to exclude the effect of oral hygiene.

Effects of Treatments.—

Effect of Preventive Treatments (Oral hygiene, silver nitrate, sodium fluoride, and black copper cement).—In *Table VI* are given the caries rates for each of the groups after two years' preventive treatment. In *Fig.* 1 these figures are compared to the 1948 "yardstick" graphically. On the basis of this method of control no reduction of caries rates has been achieved by six-monthly applications of any of these treatments. It would appear that an increase in caries rates has taken place as a result of such treatment. As the numbers in age groups are small, no fine distinctions between individual treatments may be made on the basis of such small differences between the treatment groups.

Parodontal Conditions.—Figs. 2, 3 show diagrammatically the incidence of the three standards of gingival conditions at the examinations in 1948 and 1949. The figures for the two graphs were taken from the records for all children who had received oral hygiene during the first experimental year in Groups 1–4. They show the general improvement in the gingival condition of all children, resulting apparently from the effect of regular prophylaxis and dental hygiene instruction.

Wastage.—Certain degrees of wastage were foreseen, and on advice from school authorities it was estimated that 50 per cent of the children would remain at school for the full period of ten years. Of the children who were examined after oral hygiene in 1948 only 75 per cent were available six months later. Of these, 23 per cent were missing at the end of the first experimental year. Over the whole two-year experimental period, which covers two and a half calendar years, there has been a 30 per cent wastage.

Table VI.—Average D.M.F. per Hundred Children at 1950 Examination (i.e., after two years' treatment)

Age in 1950	Oral Hygiene		Silver Nitrate		Copper Cement		Sodium Fluoride	
	Average D.M.F.	No. of Children	Average D.M.F.	No. of Children	Average D.M.F.	No. of Children	Average D.M.F.	No. of Children
6	150	2	—	—	100	4	233	3
7	200	13	200	7	250	4	225	4
8	307	29	315	13	306	18	307	14
9	352	31	375	12	390	10	338	8
10	441	27	342	12	411	9	471	7
11	427	49	622	9	450	12	533	15
12	668	34	687	8	725	8	620	5
13	1050	22	1087	12	1100	13	714	7
14	861	28	967	6	1070	10	920	10

The neighbourhood of the hospital is an area which has long been scheduled for slum clearance, consequently families are constantly moving to better housing areas. This accounts for so much wastage. Some children go for prolonged holidays to Ireland for periods up to six months, which renders regular treatment difficult. Likewise removal of some children to approved schools and orphanages does not facilitate dental research statistics. It is the general instability of this specific population that has rendered wastage so high. It will be interesting to observe whether the wastage becomes reduced and remains at a lower level once the first year of experiment has weeded out the more migrating elements of the population.

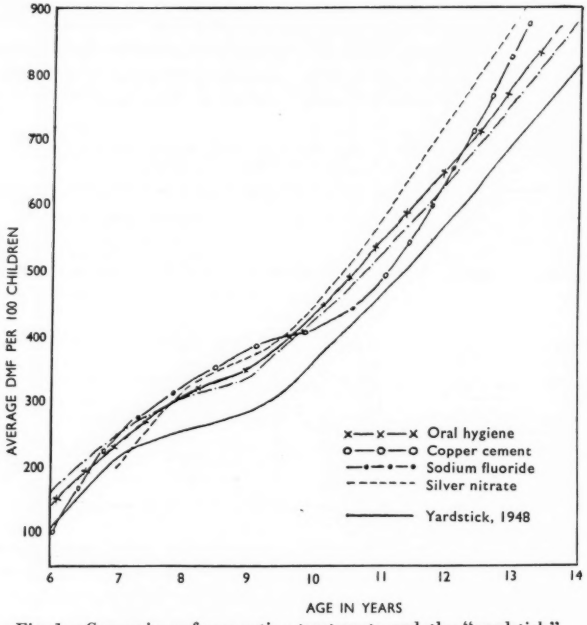

Fig. 1.—Comparison of preventive treatments and the "yardstick".

DISCUSSION AND CONCLUSIONS

Static Survey.—The general caries rates obtained from the static surveys show a high incidence of decay. Comparison of the figures in *Table I* do not show any marked increase of caries in the more recent years 1949 and 1950. This is not in agreement with other workers, who have reported an increase in caries since the war years (Mellanby, 1950). It may be that the small section of the child population examined here in 1949 and 1950 is not typical of the population in general. The relative incidence of decay in the various teeth confirms the general clinical impression that molars are the most caries-susceptible teeth in both dentitions. The preponderance of occlusal over proximal caries in the permanent teeth suggests that preventive measures during the early school years should be directed against this type of caries. The clinical examination of a mouth for the purpose of statistics necessitates the employment of exact standards. It is felt that a moderately accurate standard of occlusal caries diagnosis was effected. The method of proximal caries diagnosis, though as accurate as possible at the time, was not able, on account of the anatomical shape of the tooth, to diagnose so

small a cavity as the method employed for occlusal caries. This may have had an unbalancing effect on the proportions of the respective lesions. If proximal lesions are present but not diagnosed in the earlier ages one would expect a higher percentage of proximal caries to appear after a few years when the lesion had had time to extend to the size of being clinically detectable. Bite-wing X-rays could not be used owing to shortage of film.

It is hoped to be able to standardize caries diagnosis further by the early introduction of standard interchangeable probe points and thus to eliminate the error due to wear or to individual methods of probe sharpening.

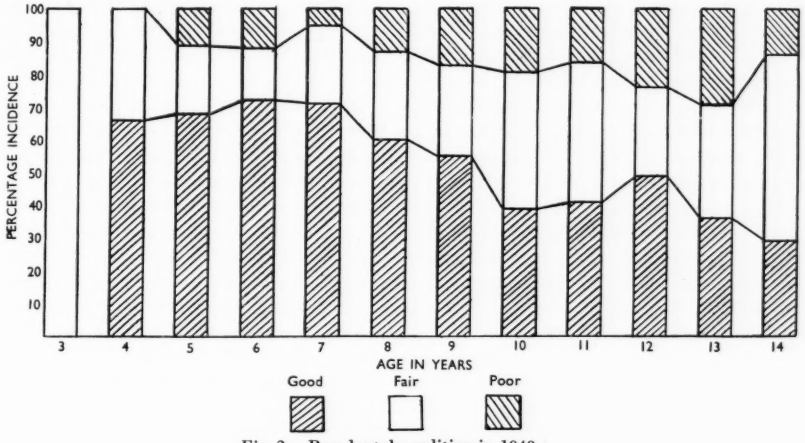

Fig. 2.—Parodontal condition in 1948.

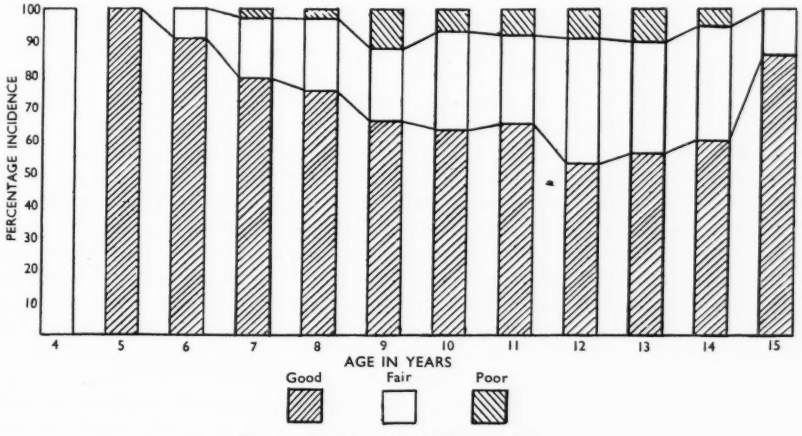

Fig. 3.—Parodontal condition in 1949.

Figs. 2, 3.—Showing the percentage incidence of parodontal disease at various age groups in 1948 and 1949 (after a year's treatment).

Preventive Measures.—It would appear that in all groups an increase in caries rates has

taken place. This is observed by control against the 1948 "yardstick", which yardstick has been annually checked for accuracy by the new entries in 1949 and 1950. No increase has appeared in the caries rates for the 1949 and 1950 new entries; the 1948 yardstick is thus assumed to be relatively accurate.

A certain degree of unbalancing has occurred in the groups as a result of wastage. In some ages the removal of several caries-resistant children from the group has tended to raise the caries rates artificially. These removals are not in such numbers or so balanced as to effect all groups evenly.

This increase in caries rates in the treatment groups may be the effect of the gradual post-war increases in sugar and carbohydrates. If so, it is difficult to explain why the treated groups show an increase and the annual new entries to the scheme do not show an increase.

It will be interesting to observe whether this increase in caries rates, apparently as the result of such preventive treatments, is demonstrated in the successive experimental years.

The copper cement group was treated with silver nitrate immediately before the copper cement at all visits until the last six months of the last experimental year. The use of eugenol as a precipitant for silver nitrate possibly impaired the adhesion of the copper cement to the tooth so that this treatment may only be said to have had an exact test for six months. The results of the next experimental year should give more definite evidence of the effect of such treatment.

No such irregularities of application have occurred with regard to silver nitrate or fluorine. No reduction of caries rates appears from the applications of silver nitrate or sodium fluoride over a two-year period. This two-year period is probably a minimum time in which any reduction could be observed. The probe method of diagnosing caries, though as accurate as at present possible, does not diagnose caries till it has proceeded from a microscopic lesion to a macroscopic lesion. A preventive measure, though possibly preventing the initiation of microscopic lesions, may not prevent the growth of such lesions to macroscopic size. Thus during an initial year of preventive treatment any microscopic lesions can continue to grow. It may not be until a second or later year that any reduction will be observed. Thus subsequent years may show the benefit of such treatments after any caries, initiated before preventive treatments were applied, has had time to "grow out".

It is admitted that the prevalent form of caries is chiefly in pits and fissures and that neither silver nitrate nor sodium fluoride has been proposed to prevent this type of lesion. This study was designed to compare the effect of treatments applied at a six-month frequency, which frequency might prove a practical proposition. A more frequent application of these treatments might produce a different result but not be practicable.

The method chosen to apply silver nitrate is empirical. The ammoniacal solution when precipitated with eugenol produces a rapid precipitation on the surface, but it is doubtful if maximum penetration occurs (Atkinson, 1950). More investigation into methods and frequency of application of silver nitrate are necessary before a final decision can be made.

Oral hygiene, though having no apparent effect on caries rates, has demonstrated its value in the improvement of the gingival condition. One factor which is not assessed here is the effect oral hygiene treatment has upon subsequent behaviour in the dental chair. After a child has been given a thorough prophylaxis which necessitates the use of handpieces and other dental apparatus subsequent introduction of conservative treatment is a much easier matter. After prophylaxis by a hygienist the child soon accepts regular dental treatment as a normal part of its life.

SUMMARY

1. A report is made of a two-year investigation into the practical effect of biannual application of preventive measures, oral hygiene, sodium fluoride, silver nitrate, and black copper cement.

2. Two static surveys were made; one in 1947 without previous prophylaxis and one in 1948 after prophylaxis on the commencement of preventive treatment. This latter survey was to act as a "yardstick" control.

3. Static survey analyses confirm the clinical impression concerning the incidence of caries in individual types of teeth, molars in both dentitions being the most susceptible teeth.

4. Assessment of caries was by D.M.F. and d.m.f. tooth index. Caries rates were expressed as average D.M.F. teeth per hundred children.

5. A relatively low incidence of proximal caries is reported.

6. The six-monthly applications of sodium fluoride, silver nitrate, and black copper cement after previous prophylaxis have produced no caries reduction. As yet there is no evidence to suggest that six-monthly applications of any of these treatments would be of value in general practice. Different frequencies of application may prove more successful. Likewise variations in the mode of application of silver nitrate might be investigated.

7. The great value of treatment of a child by a hygienist prior to conservative work is observed.

8. Reference has been made to the effect that wastage has on the balancing of groups.

This research scheme was initiated in 1947, under the guidance of Professor F. C. Wilkinson, by the late Mr. Gerald Heaton, assisted by Mr. D. Jackson, under whose supervision the analyses on the 1947–9 surveys were made.

Messrs. D. and W. Gibbs most generously supplied the dentifrice and toothbrushes.

The excellent co-operation of the staff of the schools ensured the smooth running of the scheme.

The Staff of the Preventive Clinic, apart from their various duties, gave invaluable help in the assessment and analysis of results. Dr. A. S. Prophet, together with many of my colleagues, supplied most constructive criticism. To all who have participated and helped I wish to express my most sincere thanks.

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THE JACKET CROWN

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The complete veneer, or "jacket crown", whether it be made of porcelain or acrylic resin, owes most of its success to the fact that it meets nearly all the requirements of a successful dental restoration. If placed where indicated, and if the tooth be properly prepared, it is one of the best restorations available for maintaining the pulp in a healthy condition. In addition to this, the jacket crown meets the most exacting æsthetic requirements.

Both the porcelain and the acrylic jacket crown are well tolerated by the soft tissues, but, naturally, this tolerance is dependent upon the finish and fit at the gingival periphery of the restoration, and, over a longer period of time, porcelain seems to be better tolerated, possibly because of its rigid structure. When acrylic jacket crowns were first introduced, considerable difficulty was experienced in cementation, shade control, and variation in shade, but, after a great deal of research by many workers, most of these difficulties have been surmounted. This type of crown may be used either on teeth having vital pulps, or on those from which the pulp has been removed. While its use requires enough tooth structure for a strong foundation, it is possible, by the judicious use of cast cores, to rebuild a foundation on a badly broken-down tooth.

Among the disadvantages of the acrylic restoration, there must be included the springiness of the resin, and its susceptibility to distortion if improperly cured. Intimately bound up with the springiness of the resin is the difficulty of retention by cement owing to the lack of affinity between cement and resin.

Another objection which is sometimes raised is the exactness of the technique, both in the surgery and the laboratory, but if as a result of increased care and attention to detail we provide an efficient restoration, then the care is well worth while.

INDICATIONS FOR USE

In young patients with fractured incisal tips, and with relatively large pulp chambers, the shoulderless preparation may be used with considerable success until such time as the recession of the pulp will permit a greater amount of tooth removal, and the construction of the more permanent shoulder preparation.

In patients, say over 18 years old, the jacket crown can be used in cases of hypoplasia, excessive attrition, rotation and malposition of anterior teeth, fractured tips or carious incisal involvement, and in the building out of laterals to simulate centrals.

In all cases when the construction of a jacket crown is considered, one should investigate pulp vitality, and with the use of X-rays observe the size of the pulp chamber and any aberrant pulp horns. The bite should also be carefully considered, for in close-bite cases, some modification, such as a gold backing, of the simple jacket crown may be necessary.

ANÆSTHESIA

May be: Infiltration; Block; Intra-alveolar.

If anæsthesia is necessary, one should take care not to overheat the tooth during preparation.

Some operators have considerable success with the continuous water spray, and this has a great deal to commend it, because of the protection afforded to the pulp.

THE SHOULDERLESS JACKET CROWN

Owing to the resilience of acrylic resins, it has been found that the shoulderless type of crown is not of any great permanence, and should be replaced with a shoulder crown when the pulp has receded.

Preparation.—Using disks and stones, remove the minimum amount of tooth structure which will permit withdrawal of an impression. In order to avoid possible damage to the periodontal membrane, and the production of an early gingival pocket, it is recommended that the preparation should only be carried to the crest of the gingival tissues.

THE SHOULDER JACKET CROWN

The shoulder preparation entails a study of the relationship existing between the enamel and the investing soft tissues, so that a decision may be reached with regard to the level of the gingival shoulder.

In the younger type of patient, with a high epithelial attachment and a relative absence of gingival crevice, the shoulder should not be carried too deeply or the operative trauma will predispose to pocket formation. Where the epithelial attachment lies below the cement-enamel junction, and a definite gingival crevice exists, then one should carry the shoulder well into the crevice.

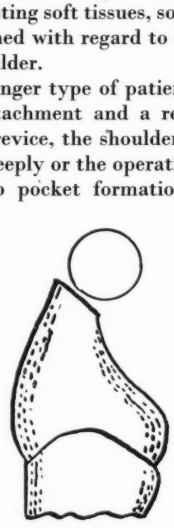

Fig. 1.—Reduction of the incisal edge.

One is sometimes called upon to make a jacket crown for a tooth with considerable gingival recession, and where the cement-enamel junction is exposed. In such cases, one should consider taking the gingival shoulder to the cemento-enamel junction only, and treating the exposed cementation as a separate problem. In teeth showing a marked tapering form, and with much exposed cementum, there is a very real danger of exposing the pulp in attempting to prepare a subgingival shoulder in the classic way.

Stages in the Preparation.—Most operators have their own particular technique, developed after much experience in this field of operative

dentistry, but for those whose experience has been limited, the following description may be of some help.

1. *Reduction of the Incisal Edge.*—Carbo or diamond stone $\frac{1}{16}$ in. wide and $\frac{1}{2}$ in. diameter (*Fig.* 1).

Reduce the incisal edge to allow, if possible, 1·5 mm. to 2·0 mm. clearance to the opposing teeth. This incisal plane in the upper with a normal bite is inclined lingually about 45° to the long axis, and in the lower preparation is inclined labially about 45° to the long axis. This inclination is to afford an opposing base to the bite force.

The dentine will now be visible between the two plates of enamel.

2. *Reduction of Proximal Surfaces.*—Safe-sided, knife-edge disk, $\frac{5}{8}$ in. to $\frac{7}{16}$ in. diameter, diamond, steel, or vulcarbo (*Fig.* 2).

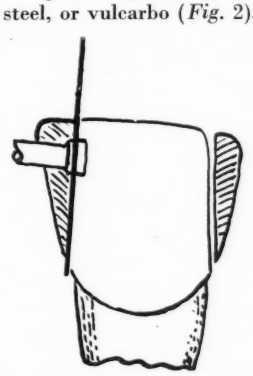

Fig. 2.—Reduction of proximal surfaces.

With the disk revolving rapidly in its guard, place its edge on the incisal plane about 1·0 mm. to 1·5 mm. from the proximal surface. The disk is inclined and its cutting edge sighted towards the point of the interdental papilla. When the cut is finally completed, the disk should emerge at the crest of the proximal tissues.

This method of proximal reduction prevents possible damage to the adjacent proximal surface.

3. *Removal of Labial Enamel.*—Using a small, knife-edge stone, cut a narrow, *shallow* groove on the labial surface, extending from the mesial to the distal slice, following the labial gingival contour, and at the height of the gingival crest. This groove serves as a useful guide in reducing the labial surface, and helps to prevent "wandering" of this margin of the preparation.

Remove the remainder of the labial enamel, using a $\frac{1}{2}$-in. stone—no attempt should be made at this stage to develop any shoulder on the preparation.

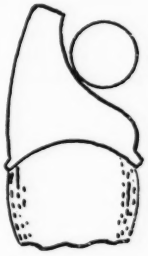

Fig. 3.—Removal of incisal two-thirds of lingual enamel.

4. *Removal of Lingual Enamel.*—This is usually carried out in two stages:—

1. Incisal two-thirds with $\frac{1}{4}$-in. wheel stone or ball-shaped stone (*Fig.* 3).

2. Gingival one-third with a knife-edged stone, followed by a tapered stone.

If one is not using hydrocolloid as a method of reproduction, then the fitting of the copper band is better done at this stage, in order to get a more accurately fitting band in which to take the impression than is possible after the gingival shoulder has been cut.

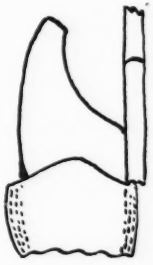

Fig. 4.—End cutting bur on gingival shoulder.

5. *Cutting the Gingival Shoulder.*—Naturally, the width of the gingival shoulder will vary according to the size of the tooth involved, and

will vary from, say, 0·2 mm. in a peg-shaped lateral, to 0·5 or 0·75 mm. in a central or canine. Every effort should be made to produce a shoulder of equal width and free from irregularity (*Fig.* 4).

Using a safe-sided disk, cut into the proximal surface to give a proximal shoulder of the required width. Tilt the disk labially and lingually to produce a shoulder following the proximal gingival contour. Using fissure burs and cylindrical stones, cut the labial and lingual shoulders, and join these to the proximal shoulders. End-cutting burs may

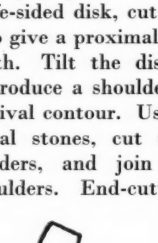

Fig. 5.—The completed preparation.

be used to finish the shoulder, and to cut it to the required sub-gingival depth. Smooth the shoulder with hatchets and chisels.

The preparation should be finally smoothed with disks, and checked for freedom from undercuts.

Summarizing the previous procedure, one might say that the finished preparation should be a miniature reproduction of the original tooth form with certain modifications (*Fig.* 5):—

1. A gingival shoulder located at, or below, the gingival crest.

> "Disease is what happens when the organism comes into conflict with some inimical agent and the symptoms that arise are but signs of what is going on in the organism as a result of the conflict."—WILLIAM A. WHITE.

2. An incisal plane at 45° to the long axis in order to meet the force of incision at right angles.

3. A lingual surface, slightly concave mesio-distally and inciso-gingivally, extending from the incisal plane to the top of the cingulum.

4. The gingival one-third of the lingual surface is changed from a convexity to an axial wall approximately parallel to the gingival two-thirds of the labial surface.

5. A labial surface which is more or less convex mesio-distally and inciso-gingivally.

6. Proximal surfaces converging slightly towards the incisal plane.

7. Sufficient clearance lingually and incisally to allow sufficient material between the preparation and the opposing teeth.

ABNORMAL CASES

Where much tooth has been lost and the pulp remains vital, an æsthetic restoration can be accomplished by the judicious use of cast-gold cores. Retention of the gold thimble can be considerably improved by the use of pins in the gingival floor and ultimately the gold reinforcement for the acrylic renders the finished crown less liable to distortion.

In close-bite cases, or where the jacket crown is to be used as a bridge abutment, then, in addition to an internal cast thimble, the crown should be provided with gold proximal surfaces and a gold lingual surface.

CONCLUSION

Much has been written concerning the laboratory technique and other details of the jacket crown (Holt and Rosenstiel, 1949), but, in conclusion, attention should be drawn to the advisability of maintaining the crowns in a wet condition until the moment of cementation. If the crown is allowed to dry out completely, on cementation it will take up water from the saliva, expand consequently, and break away from the cement bond, becoming loose, leaking, and failing in its object of providing an æsthetic, functional, and permanent restoration.

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SOME ASPECTS OF THORACIC SURGERY OF INTEREST TO THE DENTAL SURGEON

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In past days perhaps the only subject of mutual interest to dental and thoracic surgeons might have concerned the effects produced by the entry of a tooth into the bronchial tree during or after extractions. Since this accident is now rare (I have seen only 3 patients after such incidents since the end of the War) because of the adequate and careful attention paid by dental surgeons to prevent such a disaster, it might seem fruitless to discuss points of interest affecting both types of surgeons. But there are in fact many points of contact, for example, in diseases such as lung abscess, bronchiectasis, and pulmonary tuberculosis, in cardiac disease, and in certain conditions of the œsophagus.

PULMONARY ABSCESS

Before the recent war abscesses in the lung were not infrequent and carried a mortality rate of about 40 per cent. Although a serious problem often confronting the thoracic surgeon, these patients are less frequently seen, are less ill, and do not usually die at the present time. Apart from those cases due to a generalized septicæmia, often associated with the *Staphylococcus aureus*, it is commonly accepted that an abscess of the lung is due to the inhalation of septic material from the mouth and upper air-passages or to the accumulation of septic organisms beyond a block in a bronchus produced by a tumour developing in its wall, by a foreign body in its lumen, or from pressure outside the bronchus by agents such as grossly enlarged lymphatic glands. Foreign bodies and infected material from the mouth such as septic accumulation in the "tartar" behind teeth or pus from infected paranasal sinuses find their way more readily into the right bronchus than into the left because this tube is in a straighter line with the trachea than is the left one. Moreover, the fact that most people sleep on the right side and that anæsthetized patients are usually placed in this position during their post-operative phase encourages the inhalation of material from the mouth and nose into that side. For the same reason the inhalation of vomited material in the semi-conscious patient is more likely to find its way into the right lung and so set up an aspiration pneumonia. In practice lung abscess is far commoner on the right side and indeed develops most frequently in those parts of the lung that are in the lowest and most dependent position when the subject lies on the right side. Such an abscess is often seen in that part of the right upper lobe of the lung which is situated posterolaterally. The importance of this in dental, and ear, nose, and throat surgery is of considerable importance.

Lung Abscess as a Complication of Dental Disease.—In former times the inhalation of a tooth into the lung was often followed by most serious complications. If the accident was not noted at the time of the dental operation some time might elapse before the clinical complications became obvious, and it is still not widely appreciated that a bronchus can harbour a foreign body such as a meat or fish bone without severe cough resulting. The bronchial wall against which the tooth is firmly impacted may soon lose its sensitivity: if the affected bronchus is occluded by a combination of infected granulation tissue, the size of the tooth, and spasm, no further entry of air takes place into the lung beyond the block. The air entrapped distal to the obstruction is rapidly absorbed, the bronchioles and alveoli fill with mucoid secretion which can become infected as the result of organisms multiplying, and a pyrexial illness with some of the features of acute pneumonia develops. Such a condition of massive collapse (atelectasis) of a lobe is seen most commonly in thoracic surgical

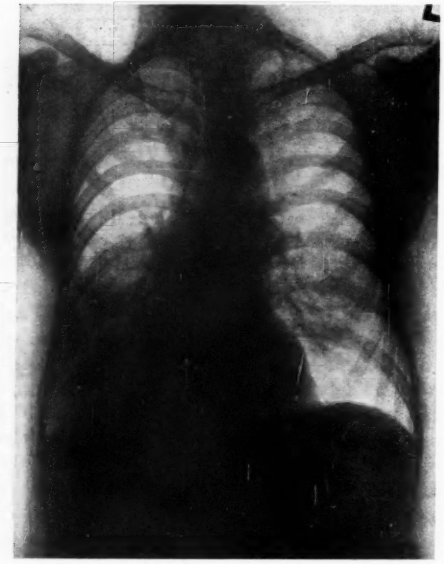


Fig. 1.—Radiograph of patient referred as "carcinoma of the right lower lobe". The radiological appearances are typical of a collapsed airless right lower lobe, and might well be due to a carcinoma obstructing the lumen of the bronchus.

practice when the bronchus is blocked by a carcinoma or by mucopurulent secretions after abdominal or thoracic operations, but the possibility of its being due to a foreign body such as a tooth or meat bone should be borne in mind.

Case.—Mr. A., aged 58, was admitted to my ward at the Queen Elizabeth Hospital in July, 1950, as a suspected carcinoma of the right lower bronchus. He said that he had been quite well until fourteen days previously, when he developed a chill with a high fever and some pain in the right lower chest: his doctor diagnosed it as right basal pneumonia and he was treated accordingly with the usual chemotherapeutic agents. After a few days he began to cough up a considerable amount of blood-stained sputum and in view of this a radiograph of the chest was ordered. This showed a shadow in the right lower chest typical of a collapsed lower lobe (*Fig.* 1). He was referred to me as a possible carcinoma, an opinion with which I completely agreed. An examination of the bronchus under direct view was advised and accepted and I accordingly passed the bronchoscope. At the commencement of the right lower lobe was a bleeding ulcerating mass: three students were in the theatre and I asked them to look as this "tumour" and never to forget that a man of this age with these symptoms and this X-ray appearance should be bronchoscoped. "Here", I said "is an ulcerating neoplasm". Expecting to secure a small section of tissue for biopsy I was astonished to feel a hard grating sensation when I placed the biopsy forceps against the ulcerating mass. The forceps readily seized the hard mass, which was extracted: it was the crown of a molar tooth! (*Fig.* 2). Beyond it lay a large collection of mucopus in the bronchus, which was sucked out, after which the patient rapidly got well, with complete loss of symptoms three weeks later (*Fig.* 3).

My own error in this matter was the failure to obtain a good history. Subsequently on cautious inquiry the patient told me that ten days before he developed "pneumonia" he had had ten teeth extracted under gas. A return to the examination of the radiograph revealed

Fig. 2.—Portion of tooth removed from the right lower lobe bronchus of patient whose radiograph is shown in *Fig.* 1.

the tooth: it had not been overlooked previously but had been regarded as an old calcified tuberculous gland, another example of which could be seen higher up in the chest.

Such stories are of considerable clinical interest, but I do not believe they are the important part of a section dealing with

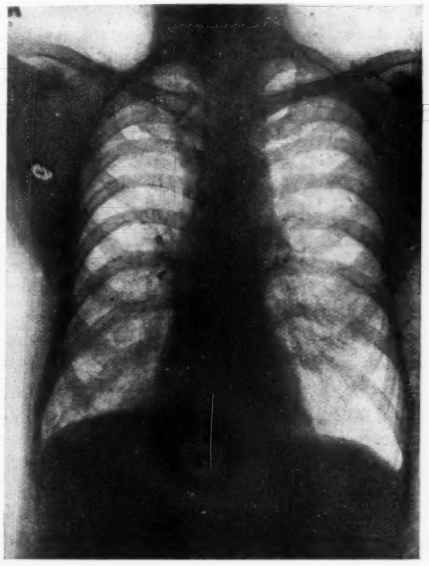


Fig. 3.—Complete re-expansion of the right lower lobe after removal of tooth. Compare with *Fig.* 1.

"lung abscess as a complication of dental disease". The improved dental hygiene of the country in the last ten to fifteen years has coincided with a decrease in lung abscess. Some years before the war lung abscesses were commonly associated with very fœtid sputum which contained the organisms commonly met with in the septic mouth, the site of gingivitis, and other diseases of dental origin. The fœtor of lung abscess is no longer common, nor is the previous frequent combination of the filthy mouth and lung abscess. Correct dental care, in my opinion, is the best prophylactic against the development of this serious combination, and, as already indicated briefly, the danger of bronchial embolism from septic material in the mouth during the hours of sleep is a great risk to the patient.

POST-OPERATIVE RISKS AFTER ANÆSTHESIA

In sound dental practice there is no risk of teeth finding their way into the bronchial tree if the standard precautions are used, but perhaps too little attention is paid to the dangers or risks of the inhalation of septic material such as blood-clot after mouth and ear, nose, and throat operations. For a period there was a vogue in some parts of the world to perform tonsillectomy in the sitting up position characteristically adopted in dental surgery and with the patient under local anæsthesia. An appalling rate of lung abscess development after this procedure led to its complete abandonment, for even in the unanæsthetized patient material can be inhaled easily into the tracheobronchial tubes. If, for instance, lipiodol, which is a radio-opaque oil, is sniffed up the nose or placed at the back of the tongue after it is held forward, a subsequent radiograph of the chest will usually disclose traces of oil in the lung fields. The simple inhalation of semi-solid material into the lungs is encouraged under deep general anæsthesia and especially during the phase of recovery from nitrous oxide when deep inspirations are taken after the apnœa of profound anæsthesia, and at this stage material can pass into the lungs. Such a misfortune is the cause of the not rare development of minor or major chest complications after dental extractions of any magnitude. From the fireside chair the thoracic surgeon would feel that all major extraction would be better executed in the prone position and that in the period of immediate post-anæsthetic recovery the patient should not be placed on the right side, but should be kept recumbent on the back with the head lowered below the level of the chest and trachea. Such, no doubt, is a counsel of perfection not readily practicable in the hurly-burly of daily practice. But to-day, with the extreme care taken by dental surgeons in preventing the entry of septic material into the air-passages, the chief risk of inhalation of

blood and infected nasopharyngeal secretions is probably in the post-anæsthetic stage.

DENTAL CARE IN PATIENTS BEING SUBMITTED TO MAJOR THORACIC SURGERY

In major thoracic surgery the pre- and post-operative care of the mouth is of great importance: the foregoing reminders will I hope have indicated the dangers of "bronchial emboli", and these risks are accentuated by surgical measures across the open pleural cavity. In such operations as removal of the lung for cancer, lobectomy for bronchiectasis, thoracoplasty for pulmonary tuberculosis, and excision of the œsophagus for cancer, the whole issue may be determined by the development post-operatively of lung complications which may have their origin in gross dental sepsis. In many of the older patients with cancer of the lung and œsophagus the dental picture may be a most unhealthy one: the care of this by extraction or less extreme measures such as adequate scaling is essential, while the other pre-operative measures such as breathing exercises, adequate provision of nutrition, and vitamin intake are being carried out. Especially dangerous is neglected dental and oral sepsis in the elderly patients being subjected to œsophagectomy and pneumonectomy, and the help of the dental surgeon is invaluable. If dental auxiliaries are to be used in any degree their work carried out under supervision could be of great value in thoracic wards.

In tuberculous patients with severe lung disease the problem of dental extractions is often a difficult one: those ill patients with active disease are easily upset by minor degrees of trauma and sepsis, and I believe that no more than two or three teeth should ever be extracted at one session in such people.

Fortunately the dental care is good in most sanatoria and really severe oral sepsis is rarely seen in these patients because their oral hygiene is carefully supervised.

Both in congenital and acquired heart disease dental surgery is often required: here the question of anæsthesia is of great interest to the thoracic surgeon. Subjects such as the blue babies with congenital disease and older patients with acquired heart disease of rheumatic origin stand anæsthesia surprisingly well if there is an adequate supply of oxygen: the only two anæsthetics that are really dangerous in my opinion are nitrous oxide and ethyl chloride, which are often the cause of considerable temporary anoxæmia. Certainly these two agents would never be allowed in a thoracic surgical service on this type of patient, and I trust my dental colleagues will forgive me for condemning the use of "gas" in patients with cardiac lesions. However skilfully administered gas and oxygen cause a considerable risk of depriving the heart muscle of oxygen and the development of the slightest degree of cyanosis is a danger signal in these ill-adjusted patients: on the other hand, anæsthetic agents which lower the basal metabolism and can be given with adequate supplies of oxygen are infinitely safer if given with a good airway and a copious flow of oxygen. Cyclopropane and oxygen or ether and oxygen after a preliminary barbiturate are the agents usually used in thoracic surgical practice when patients are being anæsthetized for operations on the heart.

In the dental treatment of patients with gross thoracic disease the dangers are not confined to those associated with the administration of the anæsthetic: especially in patients with congenital heart disease the production of a temporary bacteriæmia following the extraction of septic teeth may be the cause of a serious infection of the diseased heart valves or of any abnormal openings such as the persistent patency of the ductus arteriosus or of the foramen ovale between the two auricles, whereby the dangerous condition of bacterial endocarditis is set up. These dangers can be greatly minimized by performing the dental operations under an umbrella of penicillin, and for this reason these patients are usually treated in hospital with the antibiotic given by injection for a period of five days or so. If it is not possible to admit the patient, the penicillin can be given in two daily doses, using the slowly

absorbed preparations combined with procaine in an oily solution.

CONCLUSION

The importance of septic emboli from the mouth into the bronchial tree is emphasized: the lodgement of septic particles from a septic mouth into the lungs is one of the commonest causes of lung abscess.

Dental surgery is of great value in obviating the risks of major thoracic surgery when dental sepsis is present. The choice of anæsthesia for bad cardiac risks who require dental extractions is discussed, and it is held that the danger of a temporary bacteriæmia after dental operations in patients with heart disease is best minimized by the use of parenteral penicillin.

A PULP CONSERVATION CASE WITH SOME UNUSUAL FEATURES

By CHARLES DILLON, D.D.S., L.D.S.

THE materials used for treating the pulp were neutral calcium glyoxalate and calcium glycerophosphate.

This was the one and only case treated with these substances between 1940 and 1945. I was completely unaware of the result for nine years, and as there are certain extraordinary features connected with this case, it would be instructive to describe what happened.

CASE REPORT

HISTORY.—The patient was in her final year at High School. She came complaining of toothache, which she had had on two successive nights and which lasted about an hour each time. A week previously she had had toothache which lasted about two hours.

The large occlusal–distal cavity was an exposure which was treated with the paste as given above. That night she had severe pain in the tooth, and as the cavity was a Class 2 cavity in which I had some difficulty in making sure that the paste was retained on a sloping surface, exactly over the exposure, I thought it possible that the paste might have slipped away from the exposure during the various manipulations. I decided, therefore, to drill a convenient cavity straight through the mesio-buccal surface right into the pulp chamber directly opposite the exposure on the distal side. The paste was again inserted directly on to the bleeding pulp and immediately corked with an amalgam.

I knew that she had little discomfort for a week after this operation, for I did several other fillings for her. Then she went to the university. Taking her M.A., she proceeded to training college, then to a teaching post on the Island of Rheem, back to training college for a further course, after which she returned to Fort William for a sufficiently long period to pay me a visit.

EXAMINATION OF RESULTS.—The teeth were X-rayed, as shown in *Fig.* 1. *Fig.* 2 is a tracing of the X-ray photograph. The figures are self-explanatory, but attention may be drawn to the following points: From lines drawn parallel between the alveolar crest across the two premolars and the highest point of the pulp chamber in the second premolar, an angle of depression in the pulp chamber of the first premolar is discernible (∠ A B C). Beyond the area of the occlusal-distal filling and beyond the area of the radiolucent pulp-conservation paste a dense area of preliminary calcification can be seen. Beyond the area of the mesial buccal filling and beyond the area of the radiolucent pulp-conservation paste may also be seen an area of preliminary calcification. Beyond this area of preliminary calcification and towards the pulp is an area of true densification or true secondary dentine formation. Directly over the pulp chamber again appears an area of calcification, which I presume in time will become densified.

As regards the apex of the tooth in question, there is a certain thickening of the periodontal membrane and a loss of lamina dura definition, but, on the other hand, the tooth is actively

Fig. 1.—X-ray showing areas of calcification and densification.

vital. It is possible from the history of the case that a certain low-grade infection may have spread through the vital pulp and produced this reaction during the time the pulp was invaded, as it must have been.

Discussion.—The question arises, can a vital tooth be infected at the apex? Should the patient suffer reverse in health, will a radiologist or pathologist be justified in saying, "This is an infected tooth; remove it". It is an important problem which awaits an answer.

It may again be emphasized that the tooth is vital—as vital as the second premolar. Can

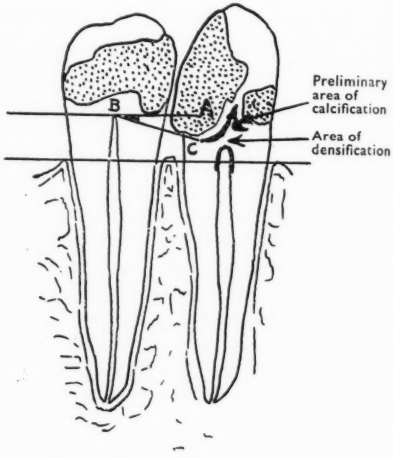


Fig. 2.—Tracing of the X-ray.

a tooth that has recovered sufficiently to lay down an area of true densification or ossification, or true secondary dentine formation, be a potential danger to health?

Will conservative dentistry develop along the lines of pulp therapy or pulp extirpation? My opinion is that pulp extirpation can show no better results, even when compared to this extreme case.

REFRACTORIES

By ERNEST A. SCHOOLDEN

Part-time Lecturer in Dental Technology, Applied Science Department, Municipal Technical School, Newton Heath, Manchester

In order to assess the possible results of a specific process, we need to be armed with an accurate knowledge of the physical and chemical properties of all the materials pertaining to it. In simple language—what is the stuff, what is it made of, what can it do or stand up to?

All dental investments are used because of their refractory nature. This word refractory is applied by scientists to substances capable of withstanding high temperatures without undergoing changes of form, or state—the so-called physical changes—and also of remaining chemically stable, in that no new substance is formed.

Many substances when heated change their state either by melting, to become liquids, or by vaporization, to become gases. Other substances sublime, and resublime—mercury and iodine for example.

THE NATURE OF CRYSTALLINE SUBSTANCES

Change of form as distinct from change of state is known as "allotropy", and is really a modification of the properties of a material due to some alteration in the atomic configuration in space of the crystal "bricks" of that material. In general, all crystalline substances are built up of unit cells, or space lattices in which a molecular pattern in space is repeated in a vast number of planes, such planes possessing more or less of "slip" according to their relationship to one another and the influence of the surrounding temperature, which really determines the rate of vibration of the atoms or "bricks" of which the lattice is built up. Although these microcosmic particles are not actually visible, their presence can be detected by means of an X-ray spectrometer.

THE X-RAY SPECTROMETER

(*Fig.* 1)

Spectrographic analysis makes use of the penetrating powers of X rays generated in a cathode-ray tube. (X rays are similar vibrations to light rays, but are of shorter wavelength and travel at a much slower rate.) On emanation they first pass through openings in two lead plates. These openings are in the

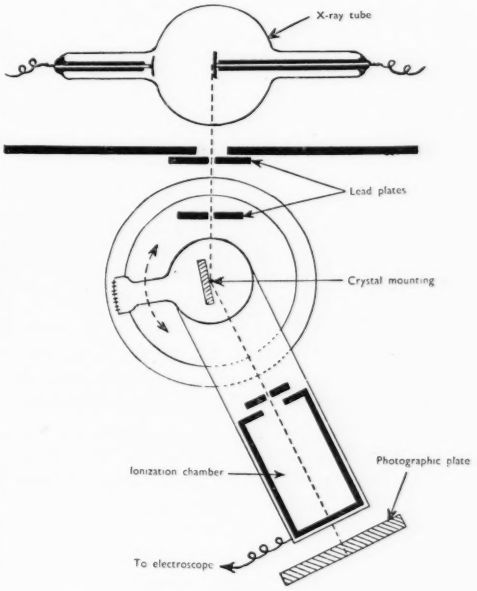


Fig. 1.—Diagram of X-ray spectrometer.

form of slits, which have the effect of collecting the rays into a pencil and preventing scattering. The rays are caused to impinge on to a face of a crystal of the substance under examination. This is mounted on a horizontal arm, revolving on a vertical axis over a graduated circle for measurement of the angle through which it can be turned. Rotation of the crystal causes one of the tiny spaces between its atoms to come before the pencil of rays, and this acts like a space in a diffraction grating. (A diffraction grating acts in a similar manner to a prism placed in the path

of a pencil of white light in that the latter is split up into a colour spectrum.) It will be seen from the sketch that at this point the rays are bent out of their normal path, and enter, by means of another slit, into an ionization chamber containing a gas such as sulphur dioxide. Inside the chamber, but out of the path of the incoming rays, is an electrode which is connected externally to a gold leaf electroscope. The entering rays "ionize" the gas, causing a current of electricity to be conducted to, and its presence shown by, the diverging leaves of the electroscope. By a trigonometrical calculation, knowing the angle subtended and the wave-length of the rays, the distance between any two atoms can be calculated. Further, if the beam is allowed to fall on to a photographic plate the relative positions can be seen as a series of dots. Armed with the above knowledge, the scientist can build up a picture of the atomic configuration in space of a crystal of any substance.

THE ROLE OF INVESTMENT IN CASTING

The refractory material in all dental investments is silica, or, chemically, silicon dioxide SiO_2. It is known to exist in three allotropic forms, as Quartz, Tridimite, and Cristobalite. At certain fixed temperatures, called inversion points, one form changes to another. Above 1470° C. all forms invert to crystobalite until the melting-point is reached. This form of silica is therefore the most stable for use in dental investments. Gold alloy, in common with all metals, is also crystalline in structure and therefore possesses a lattice. Casting gold is alloyed with copper, silver, zinc, and traces of other metals, the atoms or ions of which vibrate about a mean position whilst the metal is in the solid state. Ions are atoms which have lost or gained an electron and are therefore no longer electrically neutral. They are either more positively or more negatively charged. With rise of temperature, their rate of vibration increases until the electrostatic force holding them in their positions is overcome and the lattice collapses: the metal is melting and expanding in volume. When fluid, it is cast into the mould via the sprue. In freezing with consequent slowing up of vibration speed, the ions take up their relative positions again and the metal contracts. As is well known, this contraction is responsible for lack of fit in castings, particularly at the margins of inlays, and has to be compensated for by expanding the investment mould by the requisite amount, which in gold alloys has been found to be approximately 1·25 per cent of their fluid volume.

EFFECTS OF HEAT

The silica content, as we have seen, is the refractory compound, and it is also the compensating medium. As will be seen in the accompanying graph (*Fig.* 2), a steady expansion takes place between 300° C. and 800° C., within which is the temperature range most

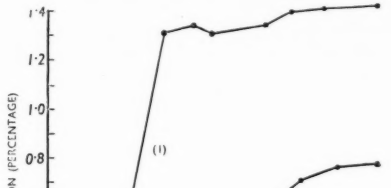


Fig. 2.—Graph showing thermal expansion of inlay investments (after Souder and Paffenbarger). (1) Investment containing crystobalite; (2) Investment containing silica in the form of quartz.

suited to gold casting, and giving a constant expansion of 1·3 per cent linear.

Expansion of investment is not sudden, however, otherwise cracking of the mould would occur. Time must be allowed for complete expansion and this is often referred to as "heat soaking". It is important to realize the full significance of this term if full benefit is to be obtained from its use. When the required temperature for casting is reached, which can be found by the experienced from

the colour of the interior of the mould, the heating supply must be regulated to maintain it steadily and accurately for approximately half an hour. (*Fig* 3.) This is not the same thing as leaving the cylinder in the furnace for half an hour extra from the time that the casting temperature was reached. If this is done without reducing the heat input, the temperature will continue to rise and the mould may become too hot. Why is this so detrimental? The reason is not hard to find, and brings us to the other main constituent of investments, the binder, as silica itself has no cohesion. The bonding material is not a refractory substance, nor has it any expansion effect of any value, because the slight increase in volume during the setting period is compensated for at high temperatures by a contraction due to loss of its water content.

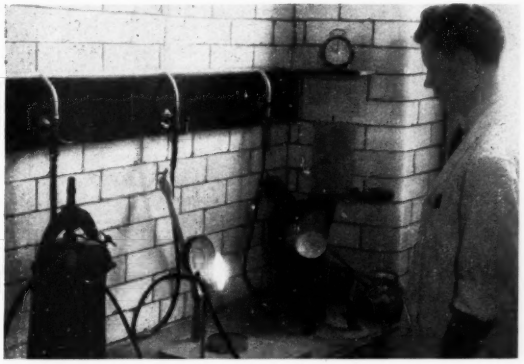


Fig. 3.—A casting ring of the size shown should be allowed to heat soak for at least half an hour before removing from the furnace, to allow full expansion of the silica content and also to drive off trapped gases.

PLASTER-OF-PARIS AND HYDROCAL

Most modern investments now contain hydrocal as the bonding agent, sometimes referred to as alpha gypsum, another example of allotropy. Hydrocal differs from plaster-of-Paris in physical properties only, due in the main to differences in manufacture. Plaster is produced by dry heating gypsum (calcium sulphate di-hydrate) in air at atmospheric pressure after drying and crushing. Heating of the large containers or "kettles" is continued until three-quarters of the water of crystallization is driven off at about 140° C. Further heating to 180° C. to dry the contents, which is now calcium sulphate hemi-hydrate, completes the kettle process. In the preparation of hydrocal the dehydration of the rock gypsum is carried out in closed containers, the temperature being raised to 120° C. by steam at a pressure of 17 lb./sq. in. for about six hours, and then dried at atmospheric pressure. This treatment results in the grains becoming single-unit particles, whereas those of "kettle plaster" are crystalline aggregates. The smaller particles of hydrocal are closer packed and so exhibit less porosity, which means water absorption is reduced, i.e., the powder/liquid ratio is increased, which results in greater crushing strength and hardness. The chemistry of the powder is exactly the same as plaster, having the formula $(CaSO_4)_2$, H_2O.

EFFECTS OF OVER-HEATING SET INVESTMENT

With rise of temperature the water of crystallization is driven off and is complete at about 450° C., leaving anhydrous calcium sulphate. If the investment mould is allowed to get too hot, this compound begins to dissociate into its elements, which recombine to form new compounds of calcium, sulphur, and oxygen. Hydrogen sulphide and sulphur dioxide are easily detected by their smell when an overheated mould is plunged suddenly

into water. It will be clear that the molten metal entering the overhot pattern chamber at a temperature of 1060–2000° C. will be capable of splitting the sulphur dioxide. Metallic sulphides are formed, resulting in a discoloured casting that will not easily clean up in the usual pickle, as these sulphides are not readily soluble in hydrochloric or sulphuric acids. Nitric acid may help, as it is a stronger oxydizing acid. When the sulphur dioxide is dissociated, nascent oxygen is evolved and this is easily "occluded" by platinum and gold-rich alloys, leaving a porous casting which cannot be properly finished. Furthermore, these gases have a deleterious effect on casting cylinders and the furnace metal. Conversely, if through underheating there has not been complete wax elimination, a bright shiny casting, with short and rounded margins, may be produced. In this case carbon from the wax has combined with atmospheric oxygen to form a reducing agent, carbon monoxide, which has cleaned off the metallic oxide layer. In order to facilitate thermal expansion of any investment, the inside of the casting ring should be lined with moistened asbestos, another refractory substance, being a double silicate of calcium and magnesium $CaSiO_3.3MgSiO_3$. This lining, on losing its moisture content, shrinks appreciably and so allows room for the investment to expand.

ADDITION AGENTS, ETC.

Various addition agents are now used by different manufacturers. A well-known inlay investment contains a proportion of graphite. Carbon has the power to absorb large quantities of gas, which would otherwise affect the metal as detailed above. Other brands contain copper carbonate and boric acid, which have the effect of "slagging off" unwanted sulphides and oxides. Another particular make increases expansion about 0·6 per cent by utilizing the property of hygroscopy. Hygroscopic expansion is, however, a rather variable quantity and research is still going on by scientists who are trying to determine the essential difference between hygroscopy and deliquescence.

STELLITE AND VITALLIUM

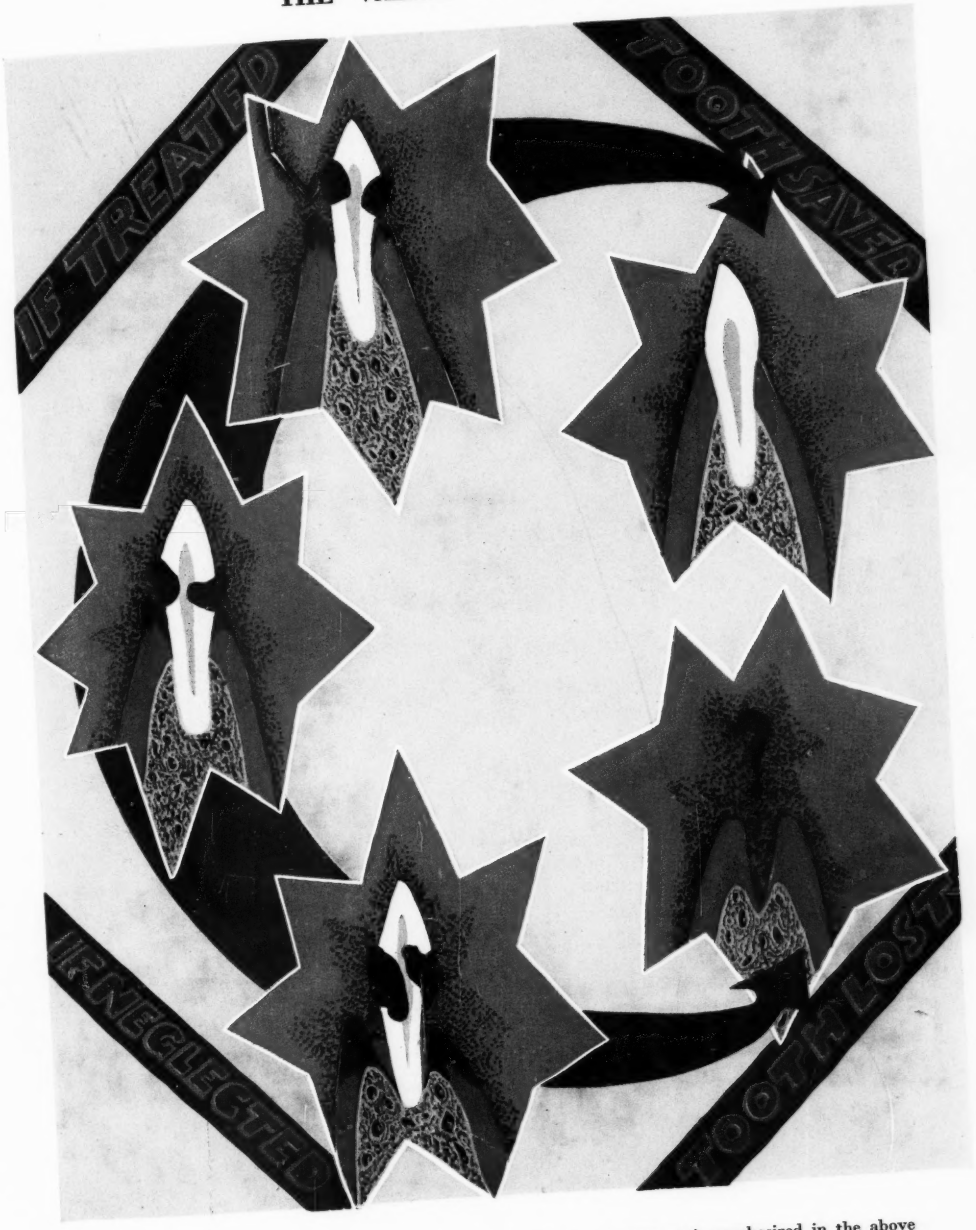
When we come to the cast steels such as Stellite and Vitallium even higher refractories are needed, owing to the extremely high temperature used in the technique. These alloys are of the solid solution type containing cobalt, chromium, molybdenum, and tungsten, all of which possess very high melting-points (1400° C. to 3300° C.). Minor additions of other metals such as nickel, beryllium, iron, and manganese, help to reduce the fusing temperature a little and improve fluidity. Freezing temperature is around 1300° C. and the alloys are hardened by heating and quenching (Martensitic) and are similar to tool steel. They should not be confused with the wrought type of stainless steel alloy which is Austenitic, and is hardened by cold working. Although the specific gravity of these alloys is much lower than gold (8·2 as compared with 19·3), freezing shrinkage is much greater, consequently a special investment is needed having a high silica content and ethyl silicate is used instead of water for mixing. A high-heat furnace is required, the casting rings must be made of immaculate metal (stainless steel), and an oxyhydrogen blowpipe is essential.

PORCELAIN

The refractory used in lining furnaces is usually kaolin, or china clay, which like silica is an acidic oxide. Clays are hydrated silicates of aluminium, $Al_2O_3.2SiO_2.2H_2O$, but are usually impure as they often contain oxides of other metals such as potassium, sodium, iron, magnesium, and calcium. These oxides tend to lower the melting-point of the pure clay, which is in the region of 1700° C., by acting as fluxes. Electric muffles used for firing porcelain crowns and inlays make use of this material, in which also is incorporated the platinum resistance wire, thus forming a heating element. China clay is one of the three basic ingredients of which porcelain is composed. The other two are potash feldspar ($K_2O.Al_2O_3.6SiO_2$), which gives a glass-like translucency as well as acting as a binder, and silica in the form of flint, which tends to reduce shrinkage—a very important factor in all ceramic work. Under the most careful

COLOURED CHART No. 2

THE VALUE OF SCALING



The importance of regular thorough scaling and gum treatment is emphasized in the above illustration. The central picture on the left shows inflamed gums due to the collection of tartar round a tooth. If this is attended to the condition returns to normal, whereas if it is neglected the tooth is lost.

H.M.

and accurate technique a minimum shrinkage of 10 per cent linear is an average estimate, and is due to loss of water content by evaporation and volumetric losses during chemical reactions at the firing temperature.

Contrary to the chemical formula above, potash feldspar is really only a partial combination of the three oxides and is known as a mixture forming a eutectiferous system. A eutectic mixture is one in which the components are soluble in one another in the molten state, crystallizing out separately until the eutectic temperature is reached, when the mass solidifies as a whole. From the above data it will be realized that a large measure of scientific control is needed in both the manufacture and use of dental refractories.

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LETTERS TO THE EDITOR

To the Editor.
Dear Sir,

I wish to congratulate you on turning out a really excellent *practical* magazine, one which, I feel sure, will go from strength to strength.

Yours faithfully,
BERNARD CAPLAN.
(*F./Officer*)

Officers' Mess,
R.A.F. Station,
Cottesmore, Rutland.

To the Editor.
Dear Sir,

May I comment on the admirable article in your last issue by Bradford. This is a subject in which I have always been interested, and I can only hope he will continue his good work and give us another article in due course.

I have made sally on this difficult subject before and gave it up in despair. I had based my experiments on the extraordinary elasticity and intractability of dentine and enamel. Even a musical note may set off a certain train of sensation in tooth structures. Perhaps Mr. Bradford would verify the following interesting observation, from which I have attempted in the past to draw tentative conclusions. My observation was that a tooth in occlusion has a more highly developed tactile sense than one that is not. Mr. Bradford need not make any immediate comment upon this point, which is only a suggestion, but I trust he will follow his own path of investigation and give us another interesting article.

I have not only read this article; I have studied it.

Yours faithfully,
CHARLES DILLON.

Caladh,
Fort William,
Inverness-shire.

THE AUTOCLAVE AND PRESSURE COOKING

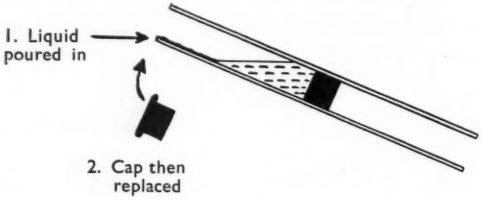
It is not generally known that the modern autoclave apparatus came originally from the first type of pressure cooker, which is not by any means new. In 1697, a French refugee in England—Denys Papin—demonstrated to the Royal Society an apparatus for cooking under pressure. He published a book on the subject if 1681 under the title of *A New Digester or Engine for Softening Bones, etc.* In the new edition in 1687 he had improved the apparatus by adding a safety-valve. On April 12, 1682, the Royal Society were served a supper which was entirely "dressed in Monsieur Papin's digesters". This "digester" was used at least as early as 1881 for the sterilization of culture media and was on its way to become the modern autoclave.—*From "Bacterial Infection", by J. L. T. Appleton.*

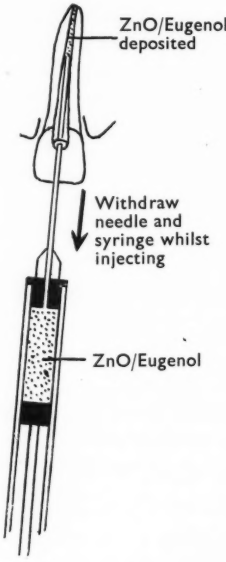
ILLUSTRATED HINTS

USED LOCAL ANÆSTHETIC CARTRIDGES FOR ROOT-CANAL TREATMENT

The rubber cap in the cartridge is removed and the rubber plunger pushed back. The cartridge is now filled with the required quantity of H_2O_2, or a thin mix of zinc oxide and eugenol, and the cap replaced.

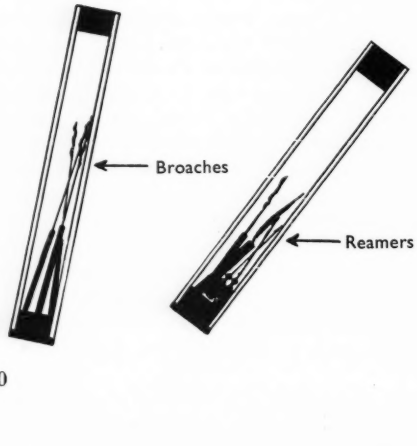
By inserting the needle of the cartridge syringe with its " cartridge " in position into the reamed root canal, a little of the liquid can be made to flow and fill the canal. It is most important to avoid creating any pressure in the canal which might result in the liquid being forced out into the periapical tissues; this can be achieved by withdrawing the needle whilst injecting very slowly.





The H_2O_2 removes any debris remaining in the canal after reaming by the evolution of oxygen, which must have sufficient room to escape around the needle into the mouth.

Excellent results are achieved with the thin zinc oxide and eugenol mix as the root canal filling, plus a gutta-percha point.



A READY-TO-USE SUPPLY OF STERILE ROOT-CANAL INSTRUMENTS

Save your glass cartridges after using local anæsthetic solution. Sterilize them (and rubber caps) and keep a number of sterilized broaches and reamers in them. Thus you have a ready supply of sterile instruments for any emergency.

Similarly absorbent points can be stored, say, half-dozen at a time, to avoid frequent opening of the paper container.

To use: (1) Remove rubber end of tube and select required instrument with sterile forceps; (2) Replace stopper.

FOR THE TECHNICIAN

TOOL RACK

This rack consists of three Juneero steel strips, which can be bought at any hobby shop. Two of the strips are bent with pliers into the form of stairs (*Fig.* 1). The other strip is then cut in half and with the aid of four 6 B.A. nuts and bolts, one piece is fastened to the base of the steps and the other to the back (*Fig.* 2). The holes can be drilled with a No. 11 rose-head bur. You now have a rack which may stand on the bench or be fastened to the wall.

[It appears that this rack would be very useful for such articles as files, wax knives, pencils, sculptors, etc.—*Editor.*]

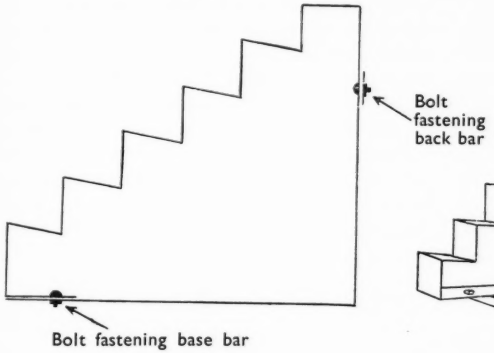


Fig. 1.—Side view of end-piece.

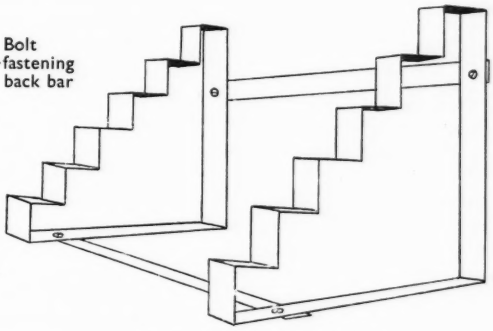


Fig. 2.—The rack completed.

NATIONAL HEALTH SERVICE NOTES

GENERAL DENTAL SERVICES

Acrylic Resin Denture Bases

PRACTITIONERS will be aware that under paragraph 5 of the Conditions with respect to Materials contained in Part 3 of the General Dental Services Fees Regulations, a plastic denture base other than vulcanite may be used only if it is a brand of acrylic resin approved for the time being by the Minister of Health for use in the making of dentures.

The Council have been informed by the Minister of Health that he has given his approval to the use of Supearl, Clinex, and Durrocryl in addition to the brands already approved.

Practitioners using these denture bases will appreciate the importance of strict adherence to the makers' processing instructions so as to avoid fractures caused by faulty processing.

Allocation of Pension in Superannuation Scheme

THE booklet A.L. has been revised to accord with the National Health Service (Superannuation) Regulations, 1950. It reproduces Regulation 11 and the First Schedule of those Regulations, and includes an explanatory memorandum and examples on the working of those provisions which govern allocation of part of a pension to provide benefits for a dependent on an officer's death.

The booklet is intended primarily for Health Service employers to hand to employees about to retire. It is also being placed on sale by His Majesty's Stationery Office, price 6d. net.

SOCIETY NOTES

FEDERATION DENTAIRE INTERNATIONALE

XIth International Dental Congress, London, July, 1952

SINCE the publication of the first *Newsletter* a number of announcements and decisions have been made which are of importance to all prospective visitors to the XIth International Dental Congress.

Conditions and categories of membership have been laid down in the recently compiled Rules of Congress. These state that: "Every practising dentist possessing a legal qualification to practise dentistry in the country in which he received his professional education, or in the country in which he lives, may become an active member of the Congress after approval by the National Committee representing the F.D.I. in those countries (in the case of Germany by the Membership Committee appointed by the F.D.I.), and on payment of the appropriate subscription. Medical graduates and licentiates and members of other scientific professions may also be admitted as active members."

Candidates for admission as members must forward an application on the official forms to Mr. H. Parker Buchanan, Secretary-General, XIth International Dental Congress, Organizing Committee, 13, Hill Street, Berkeley Square, London, W.1. Application forms are obtainable from the National Societies and Committees of the F.D.I., or direct from the Secretary of the Congress. Subscription for an active member is £5 if the postal date on the application form is prior to Jan. 1, 1952. After that date the subscription will be £5 10s. Subscriptions can now be received and cheques should be made payable to the "XIth International Dental Congress".

Individual members of the F.D.I. of not less than two years' standing, and whose subscriptions are not in arrears, shall be admitted to full active membership on payment of half the above subscription.

Undergraduates in dentistry and medicine may be admitted as Associate Members on completion of the appropriate membership form by the payment of a subscription of 10s. (ten shillings). For all other Associate Members (Dental Nurses, Hygienists, Technicians, Trade Exhibitors or their Representatives, Relatives of Members of Congress, providing they are not practising) the subscription will be £2 10s., if received before Jan. 1, 1952, or £2 15s. if received after that date.

The programme of Scientific Papers is complete. Members who wish to take an active part in the scientific deliberations of the Congress by joining in the discussions or by presenting original communications in the form of Table Demonstrations and Scientific Exhibits should make early application to Mr. G. A. Morrant, Institute of Dental Surgery, Eastman Dental Hospital, Gray's Inn Road, London, W.C.1.

OPPOSITION TO THE MINISTRY OF LABOUR TRAINING SCHEME FOR DENTAL TECHNICIANS

THE ending, by the Ministry of Labour, of the arrangement to obtain technical advice from the Union in respect to the placing of trainees in the craft of dental technician brought strong protest from the National Committee of the Associated Dental Section of U.S.D.A.W. at its recent meeting. This protest has been conveyed to the Ministry and efforts are to be made in all localities to mobilize opposition to this scheme, which has been condemned by all sections of the dental profession.

That this view represents the opinion of dental technicians throughout the country is ensured by the representative character and structure of the National Committee, whose members are elected for two-yearly periods by delegates from branches at Divisional Conferences. These Divisional Conferences are held at six-monthly intervals and are attended by the divisional member of the National Committee to report on the work of the National body and to receive instructions from branches of the tasks which they wish the National Committee to undertake. By this two-way flow a

sense of being and belonging is established in the mind of every member of the section and accounts for the strength and virility of the section, which, in a few years, has grown to a membership touching the 4000 mark.

The National Committee welcomed reports of new training classes for technicians about to commence at Glasgow and Preston and of the efforts being made in other areas to provide similar facilities. Satisfaction was also expressed at the continuing increase in the number of candidates offering themselves for the City and Guilds of London Examination and the reduction in the precentage of failures.

The adoption of the Dental Technicians Draft Bill by the National Joint Council was noted with pleasure and progress in having the measure incorporated in some future amending legislation of the National Health Service Act is eagerly awaited.

The determination of members to press their claims for improved wages was evident by the many resolutions received urging a speedy settlement of the Union's claim, and the matter will be raised at the next meeting of the National Joint Council. The hope was also expressed that agreement might soon be reached to abolish the Grade III rate in the National Agreement.

The official invitation received to co-operate with the new periodical, THE DENTAL PRACTITIONER, was warmly accepted, and all branches are to be invited to bring this new publication to the notice of their members.

THE SERVICES

The Two Fifty Club

THE Fifth Annual Dinner of the Two Fifty Club (Non-Regular Ex-Officers, Royal Army Dental Corps), will be held at the Victory Club, Seymour Street, Marble Arch, W.2., on Saturday, Jan. 27, 1951, at 6.30 p.m. Tickets are £1 1s. (excluding wines), and may be obtained from the Secretary, Major J. W. Cooper, 726, Fulham Road, London, S.W.6. Early application should be made as the number of tickets is limited.

ABSTRACTS

from Other Journals

Diseases of the Hands and Nails

This article—65 pages and well illustrated—is too long for an abstract, but its reading would easily repay the effort. The dentist is in a position to notice the hands of patients, and the role of focal infection in systemic disease is so important that it is his duty to recognize certain dermatoses, not only for the benefit of his patients, but for the safe keeping of his own hands. Of particular interest to the dentist are radiodermatitis, the primary cutaneous irritants, and allergy, as well as infections and eczematoid eruptions. The article is highly recommended.—CURTIS, ARTHUR C., and KIRKMAN, LEWIS W. (1950), *Oral Surg., oral Med., oral Path.*, **3**, 289.

For those interested, two other papers are suggested for reading matter: (1) CURTIS, A. C., and SLAUGHTER, J. C. (1947), "The Clinical Diagnosis of Dermatological Lesions of the Face and Oral Cavity (1)", *Amer. J. ortho. oral Surg.* (Oral Surg. sect.), **33**, 218. (2) CURTIS, A. C., MARSHALL, L. F., and RUTTAN, H. R. (1950), "The Clinical Diagnosis of Dermatological Lesions of the Face and Oral Cavity (2)". *Oral Surg., oral Med., oral Path.*, **3**, 750.

A Preliminary Report on the Efficacy of Molten Metal for Sterilization of Root-canal Instruments and Material

The accepted methods of sterilizing surgical instruments require that a high degree of temperature be maintained for a definite period of time. This report deals with a method of sterilizing root-canal instruments and material by submersion in molten metal. In the treatment of an infected root canal the instruments used, although sterilized by autoclave or in a hot-air oven first, are easily

contaminated and the chain of asepsis broken. One solution to the problem is to have equipment near the chair which could be used for sterilizing the instruments before and immediately after use. The molten metal sterilizer used in this report was a small electrically-controlled sterilizer containing lead–tin solder. The temperature ranged from 260° C. to 280° C. in one model and from 218° C. to 226° C. in another. Root-canal instruments such as reamers, files, and broaches, and material such as absorbent paper points and cotton pellets were carefully sterilized in a hot-air oven. They were then contaminated with a well-mixed culture of organisms, and others merely rolled between the fingers to transfer any bacteria present on to the instrument. Each article after contamination was submerged in molten metal for a specific interval of time (two, five, seven, and ten seconds) and placed in a culture tube and incubated for at least five days at 37° C. before readings were made.

In was found that metal instruments were sterilized after submersion for two or more seconds, absorbent points after five seconds, and cotton pellets after ten seconds.

The authors state that no final conclusions can be drawn from this work, but it is apparent that this is a method which will greatly help in the sterilization of instruments for root-canal therapy and aid in the ultimate result of the treatment.—STEWART, G. G., and WILLIAMS, N. B. (1950), *J. Amer. dent. Ass.*, **3**, 256.

Antibiotics in the Treatment of Yeast-like Infections of the Root Canal

Since the advent of modern antibiotics in the treatment of infected root canals it is now actually necessary to determine the bacteria present and their sensitivity to the antibiotics used. Rapid sterilization of root canals may be achieved by using a combination of penicillin and streptomycin. In a small percentage of cases it has been found that certain root canals still remain culture positive even after this treatment. Microscopic examination identified these organisms as yeasts, and they have now been found to be the organism *Candida* (Monilia) *albicans*. The authors found that 19 per cent of positive cultures were identified as yeasts.

The article reports a study to investigate the most favourable therapy for their eradication, and to find an antibiotic or combination of antibiotics for this purpose. Both penicillin and streptomycin are ineffective against these yeasts, separately and in combination. Other antibiotics were used but all proved ineffective except in the case of tyrothricin, which is capable of destroying the organism. Since tyrothricin is not soluble in water and has a low rate of diffusion, a new substance which does not differ from tyrothricin has been made under the name of Soluthricin. Soluthricin is tyrothricin with the addition of a quaternary ammonium type wetting agent, and is superior to tyrothricin against *Candida albicans*. There appĕars to exist no synergism in combining these two antibiotics, unlike the use of penicillin combined with streptomycin. The ultimate aim is to find a combination of antibiotics that will kill all the organisms present in the infected root canal.—SELTZER, S., and BENDER, I. B. (1950), *J. Amer. dent. Ass.*, **41**, 295.

Dentistry Defined

The World Health Organization has adopted the following definition of dentistry. It was submitted by the Hygiene Commission to the Thirty-seventh Annual Session of the International Dental Federation:—

"Dentistry is the Health Service specifically concerned with the establishment, maintenance, restoration, and improvement of the health, function, and appearance of the oral cavity and its associated parts in their relationship with the individual as a whole. This includes the recognition of the oral signs of systemic disease, the prevention and treatment of oral diseases, injuries, malformations, and deficiencies; the repair of the teeth when damaged by accident or disease, and their replacement when lost. The Field of Dentistry then, is comparable with the Field of Ophthalmology, Laryngology, Otology, and Dermatology; and its social importance and opportunities are at least as great. It is, therefore, reasonable to define Dentistry as 'Odonto-Stomatology, Branch of Medicine'."

BOOK REVIEWS

THE LAW AND ETHICS OF DENTAL PRACTICE. By R. W. DURAND, M.R.C.S., L.R.C.P., and D. MORGAN, L.D.S. (Leeds). With a Foreword by Professor R. V. BRADLAW. $5\frac{1}{2} \times 8\frac{1}{2}$ in. Pp. 98 + viii. 1950. London: Hodder & Stoughton. 7s. 6d.

SOME time ago there was a long discussion in the dental press by letters and articles on the subject of status in the profession. Every sort of reason for the lack of this elusive quality was given, but little was said about the fact that status was in the end a quality that lay within ourselves. If every member of the profession read this small book and abided by the ethics and law of dental practice, it would help in the long run to raise the status for which some of us seem to seek so ardently.

With the advent of the National Health Service it behoves every member to know the pitfalls of modern dental practice. It is, as the authors point out, and the foreword emphasizes, the responsibility of the dentist to find out what the law is, in so far as it affects him.

It is possibly even more important that the newly-qualified dental surgeon should know where he stands, and this book will help to guide his erring footsteps. Without libelling our students of the profession the authors quote the delightful words of the Dean of a professional college addressing his final-year students some years ago: "You are a set of ignorant nincompoops. You come here, you waste your fathers' time and money, you get through your examinations by hook or by crook, and you foist yourselves on an unsuspecting public." He was not speaking to dental students, and we trust that these remarks do not apply to anyone these days. But the newly-qualified dental surgeon has a lot to learn about dental practice and the book deals with subjects that are not easily taught, and in any case there is little time to teach them in the present crowded curriculum.

The book deals with each subject concisely and authoritatively in a clear matter-of-fact style which is easy to read and follow. Everyday examples are quoted to illustrate points in the law and ethics of dental practice, which will bring home to many of us our minor misdemeanours, even if it is only adding a comma between L.D.S. and R.C.S. or F.D.S. and R.C.S., or incorrectly addressing a letter to a consultant. The sections include chapters on contracts, legal obligations to patients, dangerous drugs, the risks of anæsthesia, fractures, and dentures, as well as the part of the book devoted to ethics. In addition, there are short chapters on the importance of book keeping and practice management. The book has only ninety-eight pages, but is full of information and will repay all who read it.

N. L. W.

A TEXTBOOK OF ORAL HYGIENE AND PREVENTIVE DENTISTRY. By RUSSELL W. BUNTING, D.D.Sc., and Collaborators. $6\frac{1}{8} \times 9\frac{3}{8}$ in. Pp. 240, with 137 Illustrations and 1 Coloured Plate. 1950. London: Henry Kimpton. 35s.

THIS book is dedicated to the memory of Alfred C. Fones, and it is stated in the preface that it is designed as a modern version of his *Mouth Hygiene*. Following the plan of this text-book, the various chapters are written by acknowledged experts in their subjects. Such names as Lester W. Burket on stomatitis, H. B. G. Robinson on periodontal disease, and Philip Jay on dental caries, ensure that the text is authoritative and up to date.

The comparatively long chapter on the histology of the oral structures is a good summary of the subject, but may seem unnecessary in a book of this title. It was probably included to make the volume a complete text-book for the dental hygienist. Yet the book contains much more than the requirements of these ancillary workers, as is evidenced by the full chapter on the diagnosis and treatment of traumatic occlusion.

The main emphasis is, however, correctly placed upon the importance of oral hygiene. A long chapter by Dorothy G. Hard describes scaling instruments and techniques, and home treatment. The statement that "All the necessary cleansing and polishing of the teeth

usually may be accomplished in a relatively short time by the method suggested, consuming not more than two to four hours", may may make depressing reading to those working the National Health Scheme.

The price will unfortunately place this book out of reach of the dental student. But for the practitioner who wants to know the latest techniques of preventive dentistry and the treatment of periodontal disease, it can be highly recommended. The illustrations are generally excellent, and the printing, paper, and binding maintain the high standard we expect from American text-books.

R. D. E.

INTERNATIONAL DENTAL JOURNAL.
Journal Officiel de la Fédération Dentaire Internationale. Volume I, No. 1, September, 1950. $6\frac{1}{8} \times 9\frac{1}{2}$ in. Pp. 156. Illustrated. Issued quarterly, 12s. 6d. per issue; 45s. per annum. Distributed by Cassell & Co. Ltd.

AFTER what must have appeared to be insurmountable difficulties the F.D.I. are to be congratulated on the publication of the first *International Dental Journal.* It is published in the English language with headings, summaries, and legends to illustrations in French, German, Italian, and Spanish. It is hoped that in time the whole journal will be published in these and other languages.

Under the able editorship of Professor H. H. Stones the first issue contains articles by many eminent men of the profession throughout the world. The policy of the journal with regard to the articles is broadminded, for they are to include a critical survey of modern methods as well as the individual author's views in his own speciality.

The F.D.I. has always served a useful function for the profession, and the publication of this journal will widen its field of influence. There is more than one "Iron Curtain" in the world, and all too often we hear the question "What is dentistry like in such and such a country". The work of the F.D.I. gives us a chance to know our colleagues and the standard of their work in other countries behind the "Dental Iron Curtains".

There are forty-five affiliated countries in the F.D.I. and a journal that can collect material from such a wide field is indeed fortunate and its future should be assured. It is well produced on excellent paper, and the price should not deter members of the profession from subscribing to a journal produced by the ablest members of an international profession.

N. L. W.

A TEXT-BOOK OF ORTHODONTIA. By ROBERT H. W. STRANG, M.D., D.D.S. Third edition. $5\frac{3}{4} \times 9\frac{1}{8}$ in. Pp. 825, with 583 Illustrations and 5 Plates. 1950. London: Henry Kimpton. 105s.

THIS edition, like its predecessors, bears the stamp of the experienced clinician. As a complete text it is meat for the graduate rather than the dental student. The object of the chapters devoted to technical procedures is to detail explicit instruction in the use of one device—Angle's edgewise arch. The author achieves this purpose admirably, but does not attempt to present methods of treatment with other appliances. Those sections dealing with the principle of arch wire manipulation are of interest to all who practise with fixed appliances. Technical procedures are described in extreme detail. Methods of treatment of malocclusion are those according to the teaching of Tweed.

In the chapters devoted to theoretical presentations the author has drawn liberally from the writings of colleagues. These include, among others, Brodie, Noyes, Broadbent, Wienmann, and Sicher. The resultant text is very sound and the reader who may wish to inquire further is generally directed to the original papers, without too much space being given to bibliography.

The section on case analysis has been modified in this edition to show the use of orientated profile radiographs in conjunction with the other factors in diagnosis. Regarding the contra-indications for denture expansion, reference might well have been made to the early work of Chapman in this field.

Production is of a high order.

J. S. B.